

Page 6 after the paragraph regarding Figure 12 insert the following paragraphs:

Figure 13 is a schematic view of the top drive and elevators of the rig of Figure 1, shown picking up an element of a bottom hole assembly.

Figure 14 is a schematic view of the top drive and elevators of the rig of Figure 1, shown securing the element of Figure 13 to a lower portion of the bottom hole assembly.

Page 6:

The trailer 20 has mounted thereon retractable outriggers or stabilizer legs 28 for stabilizing and levelling the rig for drilling. Three stabilizer legs 28 are located on each side of the rig, at the front of the lowered middle portion 26, the rear of the lowered middle portion 26 and at the rear of the trailer 20. The stabilizer legs 28 have pontoons (~~not shown~~) 29 mounted at their ends to ensure positive contact with the ground. In the preferred embodiment rig, a single long pontoon is attached to the front two legs 28 on each side of the rig, while a shorter pontoon is attached to the rear leg 28 on each side.

Page 7:

The rotary table 32 is a collar adapted to engage down-hole equipment including tubing (coiled tubing or jointed-pipe for example) through the use of slips or wedges (~~not shown~~) 33 (Figures 13, 14), and which is hydraulically powered for rotation. The rotary table 32 is used to engage and rotate (or prevent rotation of) equipment inserted therein. The substructure 30 also has mounted thereon BOP hangers (~~not shown~~) 37 below the rotary table 32 to allow raising and lowering of BOP's (blow-out preventers) off of, and onto a wellhead.

Page 7:

The mast 34 is pivotally attached to the substructure 30 at mast mounting pins 38 for pivotal movement between a horizontal transportation position as shown in Figure 7, and a vertical operating position as shown in Figure 1. Although not illustrated, the rig could be modified such that the mast 34 could also operate at any operating angle in between the horizontal and vertical position to permit off-vertical drilling. Such modifications would include providing a support for the mast at off-vertical angles, and modifying the placement of the rotary

table 32 and BOP hangers 37 to accommodating tilting of these elements with the mast. The vertical / horizontal orientation of the mast is controlled by a hydraulic cylinder 40 connected at its ends to the trailer 20 and the mast 34.

Page 8:

The coiled tubing injector 48 is mounted atop the injector dolly 46 and consists of a series of rollers and guides (not shown in detail) used to push, pull and guide coiled tubing 54 into and out of the well. The structure and functionality of coiled tubing injectors are well known and will not be discussed in detail herein. Extending from the top of the injector 48 is an injector arch 56 used to guide the coiled tubing 54 in a gentle arch prior to entry into the injector 48. Extending below the injector 48 is a telescoping lubricator 58 which serves to guide the coiled tubing 54 as it exits the injector 48. The lubricator 58 is telescoping to permit access to the coiled tubing 54 during connection / disconnection with a bottom hole assembly 59 (Figures 13, 14) as further discussed below. The lubricator 58 is extended or contracted by the lubricator winch 52 located below the injector dolly 46.

Page 9:

The mast 34 of the preferred embodiment rig is composed in part of square tubing (not shown) running along a substantial portion of the length of the mast 34. Riding along, and slidable on this square tubing is a top drive 60 operable to engage and rotate downhole equipment (which equipment may or may not be in the well when engaged or rotated by the top drive 60) such as jointed-pipe, bottom hole assembly (BHA) elements, etc. As with the coiled tubing injector 48, the structure and functionality of top drives 60 are well known in the field and will not be discussed in detail herein. The top drive 60 of the preferred embodiment rig has on its underside, in line with the mast, a threaded engagement element ~~(not shown)~~ 61 (Figures 13, 14) for threaded engagement with downhole equipment. As shown in Figure 5, the top drive 60 also has pivotally connected to its underside, a pivotal engagement element consisting of links 62 extending downward, at the ends of which are mounted elevators 64. The links 62 are elongated arms which are pivotally connected to the underside of the top drive 60 by a pin-and-bolt connection. The angle at which the links 62 are situated at a given time is controlled by hydraulic cylinders (not shown) connected to the links 62 and to the body of the top drive 60.

The elevators 64 are adapted to engage down-hole equipment such as jointed-pipe 65 (Figure 5), casing, or BHA elements 59 (Figures 13, 14), but to also allow down-hole equipment to pass therethrough when upward force is exerted on the down-hole equipment, so as to engage the threaded engagement element. Typically, such down-hole equipment have a bulge or “tool joint” at their upper ends to accommodate engagement by tools such as elevators 64. Figure 13 shows elevators 64 engaging the tool joint to pick up an element 59b of BHA 59. Figure 14 shows elevators 64 moving downward relative to BHA element 59b as top drive 60 is lowered and BHA element 59b is supported on the lower portion 59a of BHA 59, which in turn is held by slips 33 in rotary table 32. The function of the links 62, the elevators 64 and the hydraulic cylinders controlling the angle of the links is to allow the top drive 60 to engage downhole equipment which are not necessarily in line with the mast. This feature allows the top drive 60 to pick up downhole equipment from a transport truck, for example, for placement into the well, as discussed further below.

Page 12:

In a typical drilling application, the top drive 60 will then be used to drill a pilot hole using jointed-pipe 65 (Figure 5). The process of jointed-pipe drilling is well known to those in the relevant field and is not discussed in detail here. The coiled tubing injector 48 is moved to its second position during this procedure, using the injector cylinders (not shown), such that the injector 48 is out of line with the mast 34 to allow the top drive 60 to drill using jointed-pipe 65.

Page 13:

The first step in the coiled tubing drilling stage using the preferred embodiment rig of the present invention is to assemble a ~~bottom-hole~~ BHA assembly (BHA) 59 (Figures 13, 14) and connect it to the end of the coiled tubing 54. As this preferred embodiment rig is uniquely suited to perform this task in an efficient manner, this procedure will be discussed in some detail.

Page 13:

The BHA 59 (Figures 13, 14) typically consists of the various elements to be located at the end of the coiled tubing 54 to allow coiled tubing 54 to be used for drilling. Of course the BHA 59 may additionally, or alternatively consist of other down-hole equipment such as sensors or samplers used to determine properties of a particular down-hole formation. Typical drilling elements included in a drilling BHA 59 include a bit, a mud motor, drill collars, and survey tools. Each of the BHA elements 59 is typically threaded at its lower and upper ends so as to permit threaded engagement with each other, as well as with the threaded end of the coiled tubing 54.

Page 13:

During the first series of steps, it is necessary for the coiled tubing injector 48 to be placed in its second position in which the injector 48 is out of line with the mast. The top drive 60 is moved to a position near the bottom of the mast 34, but still some distance above the rotary table 32 so as to allow the insertion of BHA elements 59 therebetween.

Page 13:

A bottom element 59a of the BHA 59 is then positioned such that it is in line with the mast 34 between the rotary table 32 and the top drive 60. Typically, the BHA elements 59 are brought to the well site on a transport truck, and the BHA elements 59 are placed into position using hydraulic lifting racks, a crane, an auxiliary winch located near the top of the mast 34, or by other suitable means. This bottom element 59a of BHA 59 is then moved downward so as to be inserted into the rotary table 32, as shown in Figures 13, 14. This first step may also be accomplished using the top drive 60 in a manner similar to that described below for the remaining elements of the BHA 59. The Slips 33 of rotary table 32 ~~is~~ are then operated to engage the bottom element 59a of the BHA 59.

Page 14:

Next, the hydraulic cylinders controlling the angle of the links 62 are operated to push the links out at a suitable angle as shown in Figure 13, and a second element 59b of the BHA 59 is positioned such that its upper end is adjacent to the elevators 64 of the top drive 60. Typically, the second element 59b of the BHA 59 would be positioned at an angle to the mast 34 at this

point, as shown in Figure 13. The elevators 64 are then operated so as to engage this second element 59b of the BHA 59. Because the links 62 to which the elevators 64 are mounted are connected to the remainder of the top drive 60 through a pivotal connection, this process of engaging the second element 59b of the BHA 59 can take place even when the second element 59b of the BHA 59 is not parallel to the mast 34. If necessary, the top drive 60 is then moved upward using the top drive winch 66 (Figure 5) to position the second element 59b of the BHA 59 such that it is in line with the mast 34. The top drive 60 is then lowered until the lower end of the second element 59b of the BHA 59 is adjacent to the upper end of the bottom element 59a, as shown in Figure 14. By further lowering the top drive 60, the second element 59b of the BHA 59, is pushed up through the elevators 64, between the links 62, to lie adjacent to the threaded engagement element 61 of the top drive 60. The top drive 60 and/or the rotary table 32 are then operated to allow the top drive 60 to threadedly engage the second element 59b of the BHA 59, and then to rotate the second element 59b of the BHA 59 and the bottom element 59a of the BHA 59 relative to each other so as to threadedly engage the second element 59b of the BHA 59 with the bottom element 59a of the BHA 59. Optionally, the slips 33 of rotary table 32 may be operated at this point to release the bottom element 59a, the top drive 60 may be moved down the mast 34 such that the second element 59b is inserted into the rotary table 32, and then the slips 33 of rotary table 32 may be operated to engage the second element 59b of the BHA 59. The top drive 60 is then operated to disengage from the second element 59b of the BHA 59.

Page 15:

The steps in the above paragraph are then repeated for the remaining elements of the BHA 59. When the final element of the BHA 59 has been screwed into the BHA, the slips 33 of rotary table 32 typically ~~releases~~ release the BHA 59, and the top drive 60 moves the BHA 59 partly into the well. The slips 33 of rotary table 32 then ~~engages~~ engage the BHA 59 again, and the top drive 60 disengages from the BHA.

Page 15:

The top drive 60 is then moved to a location above the coiled tubing injector 48 so as to move it out of the way. The lubricator winch 52 is then operated to retract the lubricator 58, and the coiled tubing injector 48 is moved to its first position wherein the injector 48 is in line with

the mast 34. Next, the coiled tubing injector 48 is operated to move coiled tubing 54 to a position such that its threaded end is adjacent to the upper end of the BHA 59. The rotary table 32 is then operated to rotate the BHA 59 relative to the coiled tubing so as to connect the two in threaded engagement, and the lubricator 58 is extended.

Page 15:

Finally, the slips 33 of rotary table 32 ~~releases~~ release the BHA 59, and the coiled tubing injector 48 is operated to drill the well.

Page 15:

When necessary to switch from coiled tubing operations to jointed-pipe operations, the coiled tubing 54 is extracted from the well such that the BHA 59 is suspended below the coiled tubing injector 48. The coiled tubing injector 48 is then moved to its second position in which the injector 48 is out of line with the mast, so as to allow the top drive 60 to perform jointed-pipe operations.

Page 15:

When necessary to switch from jointed-pipe operations to coiled tubing operations, the jointed-pipe 65 (Figure 5) is extracted from the well and moved out of the mast. The coiled tubing injector 48 is then moved to its first position in which the injector 48 is in line with the mast so as to be in a position to perform coiled tubing operations.